

What is Claimed Is:

1. A process for extending the lifespan of a metazoan or metazoan cells comprising administering to said metazoan a composition comprising a C₆₀ compound having
 5 x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

2. The process of claim 1 where x is 4.

10 3. The process of claim 2 wherein said composition comprises said C₆₀ compound, its pharmaceutically acceptable salts and pharmaceutically accepted esters, and a pharmaceutically acceptable carrier, present in said composition in a therapeutically effective amount.

4. The process of claim 1 wherein x is 3.

15 5. The process of claim 4 wherein said C₆₀ compound is C₃ tris malonic acid C₆₀.

6. The process of claim 1 wherein said C₆₀ compound is administered intravenously, intramuscularly, subcutaneously or orally.

7. The process of claim 6 wherein said C₆₀ compound is administered intravenously, intramuscularly or subcutaneously in an amount of at least 0.1 mg/kg.

20 8. The process of claim 7 wherein said C₆₀ compound is administered intravenously, intramuscularly or subcutaneously in an amount of about 3 mg/kg.

9. The process of claim 6 wherein said C₆₀ compound is administered orally in an amount of at least 0.1 mg/kg.

10. The process of claim 6 wherein said C_{60} compound is administered orally in an amount of about 15 mg/kg.

11. The process of claim 7 wherein said C_{60} compound is administered daily.

12. The process of claim 9 wherein said C_{60} compound is administered daily.

5 13. The process of claim 1 wherein said metazoan is a vertebrate.

14. The process of claim 1 wherein said metazoan is a mammal.

15. The process of claim 1 wherein said metazoan is a human.

10 16. A process for extending a metazoan's lifespan comprising regularly administering a superoxide dismutase-mimetic to said metazoan wherein said metazoan's lifespan is extended.

17. The process of claim 16 wherein said superoxide dismutase-mimetic comprises a non-metallic compound.

18. The process of claim 17 wherein said superoxide dismutase-mimetic comprises a carboxyfullerene.

15 19. The process of claim 18 wherein said carboxyfullerene comprises a C_{60} compound having x pairs of adjacent carbon atoms bonded to two carbons of said C_{60} compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

20 20. The process of claim 19 wherein x is about 4.

21. The process of claim 19 wherein x is 3.

22. The process of claim 21 wherein said C_{60} compound is C_3 tris malonic acid C_{60} .

23. The process of claim 18 wherein said carboxyfullerene is administered intravenously, intramuscularly, subcutaneously or orally.

24. The process of claim 23 wherein said carboxyfullerene is administered intravenously, intramuscularly or subcutaneously in an amount of at least 0.1 mg/kg.

25. The process of claim 24 wherein said carboxyfullerene is administered intravenously, intramuscularly or subcutaneously in an amount of about 3 mg/kg.

5 26. The process of claim 18 wherein said carboxyfullerene is administered orally in an amount at least 0.1 mg/kg.

27. The process of claim 26 wherein said carboxyfullerene is administered orally in an amount of about 15 mg/kg.

28. The process of claim 24 wherein said compound is administered daily.

10 29. The process of claim 26 wherein said compound is administered daily.

30. The process of claim 16 wherein said metazoan is a human.

31. A process for extending a metazoan's lifespan comprising regularly administering an antioxidant compound to said metazoan, wherein said compound is introduced into said metazoan intravenously, intramuscularly, subcutaneously or through oral delivery.

15 32. The process of claim 31 wherein said compound comprises a C₆₀ compound having x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

20 33. A pharmaceutical composition useful for extending a metazoan's lifespan, said composition comprising a C₆₀ compound having x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to

two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

34. The composition of claim 33 wherein said composition comprises said compound, its pharmaceutically acceptable salts and pharmaceutically accepted esters, and a pharmaceutically acceptable carrier, wherein said compound is present in said composition in a therapeutically effective amount.

35. The composition of claim 33 wherein x is about 4.

36. A non-metal-containing composition which can catalytically eliminate two biologically reactive oxygen species.

37. The composition of claim 36 wherein said biologically reactive oxygen species are O_2^{\bullet} and H_2O_2 .

38. The composition of claim 36 wherein said composition comprises a carboxyfullerene.

39. The composition of claim 38 wherein said carboxyfullerene comprises a C_{60} compound having x pairs of adjacent carbon atoms bonded to two carbons of said C_{60} compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

40. The composition of claim 39 wherein x is about 4.

41. The composition of claim 39 wherein said composition comprises C_3 tris malonic acid C_{60} .

42. A catalyst useful in the elimination of reactive oxygen species, wherein the catalyst (a) comprises a malonic acid moiety and (b) does not comprise a metal.

43. The catalyst of claim 42 further comprising a fullerene moiety.

44. The catalyst of claim 43, wherein the catalyst comprises a C₆₀ compound having x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

45. The catalyst of claim 44, wherein x is 3.

46. The catalyst of claim 42, wherein the reactive oxygen species is hydrogen peroxide.

47. The catalyst of claim 42, wherein the reactive oxygen species is a superoxide anion.

48. A method of enhancing the elimination of reactive oxygen species in a cell, comprising contacting a cell with a superoxide dismutase mimetic, wherein the level of reactive oxygen species in the cell decreases as compared to the level of reactive oxygen species in a cell that has not been contacted with the superoxide dismutase mimetic.

49. The method of claim 48 wherein the superoxide dismutase mimetic (a) comprises a malonic acid moiety, (b) comprises a fullerene moiety and (c) does not comprise a metal.

50. The method of claim 49 wherein the superoxide dismutase mimetic comprises a C₆₀ compound having x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

51. The method of claim 50 wherein x is equal to 3.

52. The method of claim 48, wherein the cell is a metazoan cell.

53. The method of claim 52, wherein the cell is a human cell.

54. The method of claim 48 wherein the reactive oxygen species is a hydrogen peroxide.

55. The method of claim 48 wherein the reactive oxygen species is a superoxide anion.

5 56. A process for extending the lifespan of a human comprising administering to said human a composition comprising a C₆₀ compound having x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

10 57. The process of claim 56 where x is about 4.

58. The process of claim 56 wherein said composition comprises said C₆₀ compound, its pharmaceutically acceptable salts and pharmaceutically accepted esters, and a pharmaceutically acceptable carrier, present in said composition in a therapeutically effective amount.

15 59. The process of claim 56 wherein x is 3.

60. The process of claim 59 wherein said C₆₀ compound is C₃ tris malonic acid C₆₀.

61. The process of claim 56 wherein said C₆₀ compound is administered intravenously, intramuscularly, subcutaneously or orally.

20 62. The process of claim 61 wherein said C₆₀ compound is administered intravenously, intramuscularly or subcutaneously in an amount of at least 0.1 mg/kg.

63. The process of claim 62 wherein said C₆₀ compound is administered intravenously, intramuscularly or subcutaneously in an amount of about 3 mg/kg.

64. The process of claim 61 wherein said C₆₀ compound is administered orally in an amount of at least 0.1 mg/kg.

65. The process of claim 64 wherein said C₆₀ compound is administered orally in an amount of about 15 mg/kg.

5 66. The process of claim 62 wherein said C₆₀ compound is administered daily.

67. The process of claim 64 wherein said C₆₀ compound is administered daily.

68. A process for extending a human's lifespan comprising regularly administering an antioxidant compound to said human, wherein said compound is introduced into said human intravenously, intramuscularly, subcutaneously or through oral delivery.

10 69. The process of claim 68 wherein said compound comprises a C₆₀ compound having x pairs of adjacent carbon atoms bonded to two carbons of said C₆₀ compound wherein said adjacent carbon atom is further bonded to two groups of a general formula -COOH and -R, wherein R is independently selected from the group consisting of -COOH and -H, and wherein x is at least 1.

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